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A Screening Procedure for Oropharyngeal Dysphagia

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Abstract. The present study was designed to examine the sensitivity and specificity of a 28-item screening test in identifying patients who aspirate, have an oral stage disorder, a pharyngeal delay, or a pharyngeal stage disorder. The screening test includes 28 items divided into 5 categories: (1) 4 medical history variables; (2) 6 behavioral variables; (3) 2 gross motor variables; (4) 9 observations from oromotor testing; and (5) 7 observations during trial swallows. Results identified variables that were able to classify patients correctly as having or not having aspiration 71% of the time, an oral stage disorder 69% of the time, a pharyngeal delay 72% of the time, and a pharyngeal stage swallowing problem 70% of the time. Sensitivity and specificity for each of these judgments and all 28 items on the test are also provided. Results are discussed relative to statistical, clinical, and third-party perspectives on the goals of screening, data from other screening tests, and the role of screening versus diagnostic testing in care of dysphagic patients.

Key words: Dysphagia — Swallowing — Screening — Symptoms — Pharyngeal physiology — Deglutition — Deglutition disorders.

A screening procedure is generally designed to identify patients at high risk for a particular problem such as dysphagia, whereas a diagnostic procedure is designed to identify the abnormal anatomy or physiology causing the problem. Screening procedures look at symptoms, whereas diagnostic procedures look at anatomy and physiology. In the case of swallowing, symptoms include coughing or throat clearing, gurgly voice, multiple swallowing, and food left in the mouth. In contrast, anatomic and physiologic disorders include poor vertical tongue motion, delay in triggering the pharyngeal swallow, reduced laryngeal elevation, reduced closure of the airway entrance, etc. In recent years, a number of screening tests for dysphagia have been developed including the 3 oz. water test [1] and the timed swallow [2,3]. Other procedures have been examined for their ability to identify patients at risk for aspiration, for example, cervical auscultation [4] and the blue dye test [5,6], the clinical/bedside assessment [7], and videoendoscopy [8]. When a procedure is used to define presence or absence of a symptom, such as aspiration, it is being used as a screening test. If it is being used to define physiology, it is a diagnostic tool. In most cases, these screening tests and procedures have been examined for their ability to identify patients who are aspirating and who need further physiologic, usually radiographic, assessment.

In general, screening tests are designed to be quick (15–20 min), relatively noninvasive, with little risk to the patient while identifying the symptoms of dysphagia requiring in-depth diagnostic (anatomic and physiologic) assessment. Many of the existing screening tests have been examined only for their ability to identify patients who aspirate and to separate them from those who do not aspirate. Few screening tests have been studied for their ability to also identify those patients with or without an oral stage disorder, with or without a pharyngeal delay, and with or without a pharyngeal stage swallowing problem. Nonetheless, there has been continuing concern by clinicians and third-party payers that patients with pharyngeal stage dysphagia should receive a diagnostic physiologic study of their swallow to define the nature of the dysphagia, e.g., reduced tongue base retraction, reduced laryngeal elevation, reduced laryngeal closure, etc., before appropriate treatment can be planned. In contrast to patients with pharyngeal stage dysphagia, those with oral stage dysphagia may not need a physi-

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ologic diagnostic study beyond an in-depth bedside assessment. Screening procedures need to be examined for their ability to define which patients have the various foci of swallow disorder, i.e., oral stage problems, a pharyngeal, delay and/or a pharyngeal stage disorder and thus identify those who need this more in-depth physiologic assessment.

The sensitivity of available screening tests and procedures in defining aspiration and their specificity in identifying patients who do not aspirate have tended to be in the range of 50% to 80%. In general, in these studies, the higher the sensitivity, the lower the specificity. A procedure with high sensitivity but low specificity, i.e., one that identifies with high likelihood that a patient has a particular disorder but overidentifies patients who actually do not have the disorder, is not as useful a procedure statistically as one of similar accuracy with equally high sensitivity and specificity.

In addition, several of the proposed screening tests involve giving the patient designated amounts of water and instructing the patient to swallow continuously (the 3-oz. water test) or as rapidly as possible (the timed swallow test). If the patient aspirates a significant amount, these latter tests have the potential to introduce a large amount of water rapidly into the patient's airway.

The present study was designed to examine the sensitivity and specificity of each item on a 28-item screening test in identifying patients who do and do not aspirate and do and do not have an oral stage disorder, a pharyngeal delay, or a pharyngeal stage disorder. The goal was to define a relatively low-risk, inexpensive screening procedure that had relatively equal sensitivity and specificity and high accuracy for these judgments in a heterogeneous group of dysphagic patients.

Methods

Twenty-eight patient variables that clinicians typically examine and consider when identifying a patient as dysphagic and when deciding whether or not to refer the patient for a diagnostic assessment were identified.

Two hundred consecutive patients referred by their physicians for assessment of potential oropharyngeal dysphagia were screened by using the Northwestern Dysphagia Patient Check Sheet within 1 day of receiving a diagnostic radiographic evaluation (modified barium swallow) of oropharyngeal swallowing. The patients in the analysis included 51 patients who had suffered a single stroke, 18 patients who had suffered multiple strokes, 26 patients who had undergone treatment for head and neck cancer, 21 patients with spinal cord injuries, and 84 with other etiologies. Mean age of the group was 65 years, with a range of 14 to 97 years. Clinicians doing the radiographic study were blinded to any information from the screening procedure.

The screening procedure consisted of 28 items divided into 5 categories, each including multiple variables (Table 1): (a) 4 medical history variables including history of recurrent pneumonia, frequent temperature spikes, question of aspiration pneumonia, and history of long-term intubation (1 week or more) or tracheostomy (6 months or more); (b) 6 behavioral variables including alertness, cooperativeness/agitation, attention/interaction ability, awareness of problem(s) swallowing, awareness of secretions, ability to manage secretions; (c) two gross motor function variables including postural control and fatigability; (d) 9 observations from oromotor testing including oral, pharyngeal, laryngeal anatomy and physiology, ability to follow directions, dysarthria, facial weakness, oral apraxia, oral sensation, pharyngeal wall contraction on gag, saliva swallowing and voluntary cough or throat clearing; and (e) 7 observations during trial swallows including

Table 1. Categories of variables on the Northwestern Dysphagia Patient Check Sheet; each variable is rated as ''safe'' or ''unsafe'' for each patient

	Safe	Unsafe
Medical history variables		
1. History of recurrent pneumonia	☐	☐
2. Frequent temperature spikes	☐	☐
3. Question of aspiration pneumonia	☐	☐
4. Long-term intubation (+1 wk) or tracheostomy (+6 mo)	☐	☐
Behavioral variables		
5. Alertness	☐	☐
6. Cooperativeness/agitation	☐	☐
7. Attention/interaction ability	☐	☐
8. Awareness of problem(s) swallowing	☐	☐
9. Awareness of secretions	☐	☐
10. Ability to manage secretions	☐	☐
Gross motor function		
11. Postural control	☐	☐
12. Fatigability	☐	☐
Oral motor test results		
13. Oral, pharyngeal, laryngeal anatomy and physiology	☐	☐
14. Ability to follow directions	☐	☐
15. Dysarthria	☐	☐
16. Facial weakness	☐	☐
17. Oral apraxia	☐	☐
18. Oral sensation	☐	☐
19. Pharyngeal wall contraction on gag	☐	☐
20. Saliva swallowing	☐	☐
21. Voluntary cough, throat clearing	☐	☐
Observations during trial swallows: 1 cc thin liquid, 1 cc pudding, ¼ Lorna Doone cookie (if chewing was possible)		
22. Apraxia of swallow	☐	☐
23. Oral residue	☐	☐
24. Coughing/throat clearing	☐	☐
25. Delayed pharyngeal swallow	☐	☐
26. Reduced laryngeal elevation	☐	☐
27. Gurgly voice	☐	☐
28. Multiple swallows per bolus	☐	☐
Three additional summary variables were created from the categories above:		
1. the total number of unsafe observations made on the 28 variables in all 5 categories		
2. the total number of unsafe observations made on behavioral and gross motor function variables		
3. the total number of unsafe observations made during oral motor testing and observations during trial swallows		

apraxia of swallow, oral residue, presence of aspiration as indicated by coughing or throat clearing, delay in triggering the pharyngeal swallow, reduced laryngeal elevation, gurgly voice, and multiple swallows per bolus. Because screening tests should be quick and easy to administer and should identify the presence or absence of a disorder, a rating system for scoring was deemed inappropriate and dichotomous scoring was used. Each patient was scored as safe or unsafe on each of the variables according to the criteria in Table 2.

In addition to these 28 single variables, 3 summary variables (bottom of Table 1) were created and examined for their sensitivity and specificity in the identification of presence of aspiration, oral disorder, pharyngeal delay, and pharyngeal disorder: (a) the total number of unsafe observations made in all 5 categories, (b) the total number of unsafe observations made on behavioral variables and gross motor function variables, and (c) the total number of unsafe observations made during oral motor testing and observations during trial swallows. These summary variables were dichotomized at their median values for the purposes of data analysis.

Each patient's radiographic study was reviewed for the presence of aspiration, an oral stage disorder, a pharyngeal delay, and/or a pharyngeal stage disorder by a clinician blinded to the results of the screening test.

Two levels of statistical analysis were completed. The chi-square test was used to examine the ability of each single variable to predict the presence of each of the four symptoms of interest: aspiration, oral stage disorder, pharyngeal delay, and pharyngeal stage disorder. Then stepwise logistic regression was used to find combinations of variables that were significantly ($p < 0.05$) related to aspiration, an oral stage disorder, pharyngeal delay, or a pharyngeal stage disorder. Variables identified with p values of 0.25 or less with the chi-square test were used in the logistic regression. The combinations of significant variables obtained with logistic regression were then examined for their sensitivities, specificities, and clinical usefulness. The p values for the logistic regression are based on the likelihood ratio test. SAS statistical software was used for the analysis.

Results

Identification of the Presence of Aspiration

The percentage of patients exhibiting aspiration, oral stage problems, pharyngeal delay, and pharyngeal stage problems were each fairly equally distributed across the 200 patients (Table 3). Approximately half of the patients showed each of the types of problems. Table 4 shows the 6 variables that were significantly associated with the presence of aspiration according to the chi-square test. The best single predictor of the presence of aspiration was a throat clear or cough during trial swallows, which resulted in 69% of the patients being correctly classified, a sensitivity of 78%, and a specificity of 58%. When the logistic regression analysis was completed (Table 4), 3 variables were found to be significantly related to aspiration on the modified barium swallow: coughing and throat clearing on trial swallows, reduced laryngeal elevation on trial swallows, and a history of recurrent pneumonia. Accuracy (percentage correctly classified) rose to 71%, whereas sensitivity and specificity became more equal when at least 2 of those 3 variables were present.

Identification of the Presence of an Oral Stage Swallowing Problem

Fourteen variables or combinations of variables were found to be significantly associated with the presence of an oral stage swallowing problem (Table 5). The best single predictor of the presence or absence of an oral stage problem was dysarthria, with a sensitivity of 64% and a specificity of 75%, resulting in 69% of patients correctly classified. All of the other variables correctly classified 54–67% of patients. The logistic regression for the oral stage problem resulted in no combination of 2 variables, which improved the percentage of patients correctly classified as having or not having an oral stage problem.

Identification of the Presence of Pharyngeal Delay

Table 6 presents the chi-square and logistic regression analyses for the presence or absence of pharyngeal delay. Chi-square analysis of single variables and their association with pharyngeal delay identified the summary variable of the patients being rated as unsafe on more than 8 of the 28 observations as the best predictor of a pharyngeal delay, resulting in correctly classifying 70% of the patients as either having or not having a pharyngeal delay with a sensitivity of 69% and a specificity of 71% (Table 6). Better sensitivity and specificity were defined by using the results of the logistic regression analysis. This analysis identified an unsafe ranking on at least 2 of the 3 following variables, resulting in a sensitivity of 71% and a specificity of 73%, with 72% of the patients correctly classified as either having or not having a pharyngeal delay: unsafe on more than 8 of the 28 observations, the observation of a delay in swallow on the trial swallows, and facial weakness.

Identification of the Presence of a Pharyngeal Stage Swallow Disorder

The association of the bedside and summary variables with the presence of a disorder in the pharyngeal stage of swallow is presented in Table 7. The single best predictor of a pharyngeal stage swallowing problem was reduced laryngeal elevation on trial swallows as observed by the clinician. Reduced laryngeal elevation on trial swallows resulted in a sensitivity of 72% and a specificity of 67%, with 70% of the patients correctly classified as either having or not having a pharyngeal stage disorder. The

Table 2. Definition of behavioral variables, gross motor function, and oromoter test results used in the screening test

Variable		Clinician's judgments/impressions
Behavioral		
Alertness	Alert/awake—safe	Fully alert and awake, able to participate
	Reduced alertness or lethargic—unsafe	Patient needed stimulation to remain alert/aroused; stimulus could be verbal and/or tactile; fell asleep, eyes closing or fluctuating
Cooperativeness	Calm/cooperative—safe	Patient needed no coaxing to complete evaluation
	Agitated/uncooperative, combative—unsafe	Patient constantly or partially agitated, moving about in bed/chair; refusal to complete task or accept food, hitting/pushing; verbal refusal for tasks despite understanding task or explanation
Attention or interaction ability	Attentive/well focused—safe	Good eye contact, sticks with tasks, waits for instruction/commands
	Distractible, reduced eye contact—unsafe	Patient frequently/often needs cues to do or complete tasks; looks away from speaker, needs cues to do same task time and again; talks incessantly without focus to eating/offering food
Awareness of problem(s) swallowing	Aware of problem—safe	Able to indicate (verbally, head nods, pointing) that patient has problem; describes problem if able
	Denies or unaware of problem—unsafe	Doesn't admit to swallowing problem (although it may be obvious: -coughing, food spillage from mouth); unable to self-regulate feedings; doesn't think coughing is related to difficulty swallowing (if eating already); would include aphasics or head injured patients who cannot express self or don't look distressed if problems apparent
Awareness of secretions	Aware of secretions—safe	Patient describes or gestures problem; wipes mouth with hand, tissue, tries to stop drooling; uses suction by self
	Unaware of secretions—unsafe	Patient holds secretions in mouth; drools and doesn't wipe self or make it known that patient needs to be wiped up; would include those who are unable physically to wipe self/suction and can't express need
Ability to manage secretions	Regularly manages secretions, wipes drooling, coughs, clears throat—safe	Patient able to manage secretions and does what is listed
	Gurgly voice, drooling, constant secretions—unsafe	Patient demonstrates/exhibits secretions that patient cannot or does not wipe up or can manage with suctioning independently
Gross motor function		
Postural control	Normal posture and/or able to control—safe	Patient has normal movement/bed, chair; transfers from place to place; uses bed controls
	Abnormal posture and/or unable to control—unsafe	Patient with neglect (head turn) contractured, etc.; or unable to move/transfer self; needs assistance to move, sit upright, use bed controls well
Fatigability	Does not fatigue—safe	Patient has good endurance; can complete all requested repetitions of task; stays well awake
	Fatigues easily—unsafe	Patient tires easily, asks for rest breaks; completes only a few repetitions or declines to complete tasks
Oral motor test results		
Oral, pharyngeal, laryngeal anatomy/physiology	Normal—safe	No obvious abnormalities (abnormalities include facial droops, voice quality changes: hoarse/rough, etc., impaired gag), etc.
	Abnormal—unsafe	Patient exhibits any such abnormality
Ability to follow directions	Good direction following—safe	Patient needs minimal repetition of instructions (~95% accurate)
	Unable/reduced ability to follow directions—unsafe	Difficulty following directions; patient requires multiple repetitions of directions/questions; requires tactile cues, visual cues; <90% understanding directions
Dysarthria	No dysarthria—safe	Intelligibility 95% or better; minimal to zero dificits, mild to severe or anarthric
	Dysarthria—unsafe	No speech secondary to aphasia/global is included here or report if could not assess
Facial weakness	Normal facial tone—safe	Normal symmetry and resistance
	Facial weakness—unsafe	Droop and/or reduced labial resistance
Oral apraxia	No oral apraxia—safe	Normal oromotor control
	Oral apraxia—unsafe	Signs of oral apraxia (buccal-facial) present
Oral sensation	Good oral sensation—safe	Patient able to feel touch on various parts of face or in mouth/tongue
	Poor oral sensation—unsafe	Demonstrates limited ability to feel touch on face and/or touch in mouth (had food in mouth and didn't feel it)

Table 2. Continued

Variable		Clinician's judgments/impressions
Pharyngeal wall contraction on gag	Good, symmetrical pharyngeal contraction on gag—safe	Normal gag response
	Poor/asymmetrical pharyngeal wall contraction—unsafe	Patient had reduced gag as described
Saliva swallowing	Spontaneous saliva swallowing—safe	Observed to swallow saliva on own without cues necessary, even if infrequent
	No saliva swallowing—unsafe	No observed dry swallow on saliva; built-up saliva in mouth; sometimes drool
Voluntary cough, throat clearing	Strong, voluntary cough, throat clearing—safe	Patient able to perform strong cough and/or demonstrate throat clearing on command
	Weak cough, throat clearing—unsafe	Patient has weak cough, no cough on command, or weak/inability to do throat clearing on command

Table 3. Locus of swallowing problems from the modified barium swallow in the 200 patients

Problem	Frequency	%
Aspiration		
No	93	46.5
Yes	107	53.5
Oral stage disorder		
No	95	47.5
Yes	105	52.5
Pharyngeal delay		
No	100	50
Yes	100	50
Pharyngeal stage disorder		
No	85	42.5
Yes	115	57.5

logistic regression analysis showed no combination of variables that resulted in any improvement in the percentage of patients correctly classified or in sensitivity or specificity.

Discussion

Interestingly, the results of the chi-square analyses of the single variables and their relationship to presence or absence of aspiration, an oral stage problem, a pharyngeal delay, or a pharyngeal stage swallowing problem identified single variables that could correctly classify patients as either having or not having one of these four types of problems approximately 70% of the time. This percentage was improved slightly on 2 of the judgments (aspiration and pharyngeal delay) when combinations of variables identified from the logistic regression analysis were used. This percentage for accuracy indicates that the variables under study do equally well in identifying those who have one of these categories of problems and those who do not. From the statistical perspective, this is an important characteristic for a screening test. This 28-item screening test plus 3 summary variables appears to perform better in this regard than do any of the existing tests, which usually have higher sensitivity but poorer specificity, i.e., they overidentify patients as having a particular symptom. None of the other screening procedures have been examined for their sensitivity/specificity and percentage of patients correctly classified relative to the presence of an oral stage disorder, pharyngeal delay, or pharyngeal stage disorder. Most procedures have been examined for sensitivity and specificity for the presence of aspiration only. Most third-party payers and clinicians are interested in the locus of any swallow disorder and in whether or not aspiration is present.

The relationship of sensitivity and specificity can also be considered from the clinical perspective and the perspective of the third-party payer. As clinicians, we may accept a lower specificity so that the patient at high risk for aspiration is sure to receive a physiologic study, even though a low specificity means that more patients without aspiration will receive a physiologic study, perhaps unnecessarily. From the perspective of the third-party payer, equal sensitivity and specificity may be desirable to reduce the number of physiologic studies and thus reduce cost.

This 28-item screening procedure introduces minimal risk to patients because they are given very small amounts of different foods in the trial swallow portion or are observed swallowing saliva. If the patient is eating orally, observation of their eating could be substituted for the trial swallows.

Based on the results of this study, the check sheet cannot be shortened because one of the variables of significance in predicting a pharyngeal delay is more than 8 of the 28 variables identified as unsafe by the clinician. This requires that all 28 variables be examined. The 200

Table 4. Association of bedside and summary variables with presence of aspiration for (A) those single variables with $p < 0.05$ and (B) combination of variables obtained from logistic regression

Variable	Sensitivity	Specificity	% Total correctly classified	*p*
A. Single variables				
Asymmetric/poor pharyngeal wall contraction on gag[b]	33	81	55	0.05
Cough/throat clear on trial swallows	78	58	69	<0.001[a]
Reduced laryngeal elevation on trial swallows	66	57	62	<0.001
Gurgly voice on trial swallows[c]	41	76	57	0.01
Multiple swallows per bolus	58	57	58	0.04
More than 5 unsafe ratings on oromotor testing and observations of trial swallows	58	60	59	0.01
B. Combination of variables predicting an outcome of aspiration on modified barium swallow				
Coughing/throat clearing on trial swallows	69[d]	73[d]	71[d]	<0.0001
Reduced laryngeal elevation on trial swallows	69[d]	73[d]	71[d]	0.013
History of recurrent pneumonia	69[d]	73[d]	71[d]	0.018

[a]Best single predictor.
[b]$n = 159$.
[c]$n = 198$.
[d]Performance under the rule: predict aspiration if at least 2 of 3 variables are unsafe.

Table 5. Association of bedside and summary variables with presence of an oral stage problem for those single variables with $p < 0.05$

Variable	Sensitivity	Specificity	% Total correctly classified	*p*
Not alert	23	88	54	0.04
Distractible	43	78	60	0.002
Denies swallowing problem	55	60	58	0.03
Unable to manage saliva	37	88	62	<0.001
Dysarthria[b]	64	75	69	<0.001[a]
Facial weakness	49	74	61	<0.001
Apraxia	18	96	55	0.002
Reduced oral sensation[c]	51	84	67	<0.001
Apraxia on trial swallows	17	97	55	<0.001
Oral residue on trial swallows	26	87	55	0.02
Pharyngeal swallow delay on trial swallows[d]	76	55	66	<0.001
Unsafe on more than 8 of the 28 observations	62	65	64	<0.001
Unsafe on more than two of the behavioral variables	52	66	59	0.008
Unsafe on 5 or more of the observations on oromotor testing and trial swallows	65	67	66	<0.001

[a]Best single predictor.
[b]$n = 198$.
[c]$n = 196$.
[d]$n = 199$.

patients were heterogeneous in their ages and etiologies for dysphagia. The numbers of patients in each etiologic subgroup were too small to permit statistical analysis to be repeated for each diagnosis to determine whether a ranking of unsafe on certain variables was a better predictor in certain diagnostic groups. Such further studies with this instrument are needed and are underway. A follow-up study to examine the ability of this screening instrument to separate oral from pharyngeal problems in patients with one or the other or both foci of disorders is underway. The 200 patients in the present study included only 13 with solely oral disorders, so this could not be tested in the present sample.

Also, it is critical that clinicians distinguish the difference between screening and diagnosis for the patient, the patient's significant others, and other health care professionals. Screening does not define the nature of the patient's problem; it simply identifies them as at risk for a significant dysphagia. Knowing or predicting that someone is aspirating does not tell us why the aspiration is occurring, i.e., the nature of the anatomic and/or physiologic reason(s) for the aspiration. Treatment for

Table 6. Association of bedside and summary variables with presence of a delay for (A) those single variables with $p < 0.05$ and (B) combination of variables obtained from logistic regression

Variable	Sensitivity	Specificity	% Total correctly classified	*p*
A. Single variables				
Agitated	12	97	55	0.02
Distractible	42	76	59	0.007
Denies swallowing problem	60	64	62	<0.001
Unable to manage saliva	35	85	60	<0.001
Dysarthria[a]	63	72	68	<0.001
Facial weakness	54	78	66	<0.001
Reduced oral sensation[b]	47	78	63	<0.001
Weak cough[a]	57	61	59	0.02
Apraxia on trial swallows	16	95	56	0.01
Oral residue on trial swallows	25	86	56	0.05
Cough/throat clear on trial swallows	69	46	58	0.03
Pharyngeal swallow delay on trial swallows[c]	80	58	69	<0.001
Unsafe on more than 8 of the 28 observations	69	71	70	<0.001[d]
Unsafe on more than 2 of the behavioral variables	57	70	64	<0.001
Unsafe on 5 or more of the observations on oromotor testing and trial swallows	69	70	70	<0.001
B. Combination of variables for predicting an outcome of pharyngeal delay on modified barium swallow[e]				
Unsafe on more than 8 of the 28 items	71[f]	73[f]	72[f]	0.003
Delayed swallow on trial swallows	71[f]	73[f]	72[f]	0.0004
Facial weakness	71[f]	73[f]	72[f]	0.006

[a] $n = 198$.
[b] $n = 196$.
[c] $n = 199$.
[d] Best single predictor.
[e] $n = 199$.
[f] Performance under the rule: predict delay if at least 2 of 3 variables are unsafe.

Table 7. Association of bedside and summary variables with presence of a problem in the pharyngeal stage of the swallow for those single variables with $p < 0.05$

Variable	Sensitivity	Specificity	% Total correctly classified	*p*
Facial weakness	30	52	40	0.01
Oral apraxia	5	80	37	<0.001
Reduced oral sensation[a]	28	58	41	0.04
Cough/throat clear on trial swallows	72	53	64	<0.001
Reduced laryngeal elevation on trial swallows	72	67	70	<0.001[b]

[a] $n = 196$.
[b] Best single predictor.

the patient's swallowing disorder(s) requires the latter information. Even if screening procedures become 100% accurate in defining the presence of aspiration or the presence of problems in the oral stage of swallow, the pharyngeal triggering, or the pharyngeal stage of swallow, in-depth diagnosis is still needed to define the anatomic and/physiologic nature of the problem and the effects of treatment strategies [9,10] for those with a high risk of a pharyngeal stage problem. This process is exactly parallel to screening procedures versus definitive diagnosis for breast cancer (mammography vs. biopsy) and uterine cancer (Pap smear vs. biopsy).

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